EXHIBIT A

Vishal Sharma, Ph.D., Senior Member, IEEE[1], Fellow, IETE[2]

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Current Position

Principal (2001 – Present)
Metanoia, Inc. – Critical Systems Thinking ™
34906 Herringbone Court
Union City, CA 94587-4626, USA.
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http://www.metanoia-inc.com/

PROFILE

Synopsis

International technologist and entrepreneur with 20+ years of experience in networking and telecom technologies, spanning research, industry, labs, and academia.

Focus Areas

Packet- and circuit-switched system & network architectures, protocol design, system analysis and optimization, software prototyping, network design & planning techniques and algorithms, and intellectual asset management, with applications to traditional and virtualized: Layer 1 – Layer 7 (optical, IP/MPLS, Ethernet, TCP and above) networks, wireless backhaul, wireless broadband & packet-core networks, IoT networks, and inter- and intra-data center networks.

Specific Areas of Expertise

Analysis and design of telecom and data-center systems and networks: high-speed switch/router architectures for Layers 2-7, switch scheduling and flow management algorithms, devising switch scheduling schemes and virtualization techniques; infrastructure security in SDN/NFV-enabled networks and emerging 5G networks; Carrier network roadmaps and service evolution; QoS algorithms and resource allocation schemes for wireless broadband networks (3G, WiMAX, 4G/LTE, and emerging 5G) and wireline (IP/Ethernet/ATM, optical, and next-generation SONET/SDH and OTN) networks; mobile backhaul techniques for 2G/3G and 4G/LTE networks, LTE network evolution; evaluating security issues in 3G cellular data networks; design of IP-based signaling and routing protocols for optical TDM and WDM networks, recovery schemes for MPLS and optical mesh networks; traffic

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[1] The Institution of Electrical and Electronics Engineers, Inc.
[2] The Institution of Electronics and Telecommunications Engineers, India.

engineering principles, protocols, carrier approaches, planning tools, and algorithms; analysis of all-optical switching schemes, and connection- and flow-control protocols for packet and optical networks; applying queueing theory to analyze telecommunication system design issues; frequency assignment algorithms and capacity analysis for cellular radio; patent investigation and evaluation, patent drafting, and prior art research, including claims review/de-construction, claim construction, infringement deep-dive, evidence of use audits, technology applicability and violation.

Key Achievements

- **SDN/NFV Professional Certification**, MEF, June 2018.

- "**Intensive Wireless Communications Engineering: Current Practices,**" 3-day Intensive IEEE short-course for communications professionals, successfully completed Dec. 4, 2017;

- **Multiple IEEE Communications Society courses on wireless engineering, wireless networking, wireless communications, IoT, optical networking, & satellite networking successfully completed**: *Network Function Virtualization (NFV), Software-Defined Networking (SDN) and the Road to 5G* (January 31, 2018), *Wireless Evolution of the Overall Network Architecture* (February 7, 2018), *LTE Fundamentals: The Essential*s (February 21, 2018), and *Beyond LTE: LTE Advanced, LTE Advanced Pro, and 5G* (February 28, 2018); *IoT and M2M Essentials* (June 6, 2018); *Satellite Data Communications and VSAT Networks* (December 6, 2018); *Background Concepts of Optical Communication Systems* (March 27, 2019); *Visible Light Communications* (April 3, 2019); *Optical Communication for 5G Wireless Networks* (May 1, 2019), *High-Throughput Satellites* (June 12, 2019), *Fundamentals of 5G Small Cell Deployments* (Oct. 2 2019), *Next-Generation Multi-Access Service Based 5G Architecture* (Dec. 4, 2019), *Photonic Technologies in the Data Center* (April 22, 2020)

- **12 US patents awarded** in: high-speed switch architectures, switch scheduling, optical routing, MPLS recovery, and IP control of SONET/SDH networks;

- **10 IETF RFCs published**; core contributor in the IETF to the development of IP-based signaling and routing standards for packet, TDM and optical networks; early-contributor to the Optical Internetworking Forum (OIF)'s evolving UNI and NNI signaling/routing standards;

- **Furnished first analytical (probabilistic) framework** characterizing limited wavelength translation in WDM optical networks;

- **Guest Editor of 6 Special Issues of the IEEE Communications Mag.** (IEEE's most highly cited publication with a circulation of 50K+ professionals worldwide);

- **Senior Member (2001)**, IEEE, the highest professional grade of the IEEE and a distinction held by less than 8% of the over 423,000+ IEEE members worldwide;

- **Life Fellow (2005)**, Institution of Electronics and Telecommunications Engineers (IETE), India, a distinction held by less than 7% of the approximately 70,000+ IETE members worldwide;

- **Served as an expert witness**: have been deposed, and have written expert reports.

- **Group Owner & Moderator, Carrier Ethernet Group on LinkedIn**: nurtured and grew the Group to 11,991+ telecom professionals from 140+ nations, 3,128+ companies, and 6 continents, and made it a venue for discussions of IP/MPLS, packet-optical, wireless/5G, and Carrier Ethernet systems, architecture, technology, and network deployment issues of contemporary significance.

- **Subject Matter Expert** at the Broadband Forum (2002);

- **Numerous tutorials, conference and journal papers, and book chapters published.**

Organizations Worked With or Consulted With

Multi-disciplinary Optical Switching Technology (MOST) Center at UCSB, Tellabs, Ciena, Fujitsu, Jasmine Networks, Digital Instruments, ACT Networks, Mahi Networks, Cariden Technologies (now Cisco), Cypress Semiconductor (now part of Infineon), Covad Communications (now part of FusionConnect and GTT), Xilinx, ETSA (Electricity Trust of South Australia) Telecoms (now part of Silk Telecom), SBC/AT&T, France Telecom/Orange, Wipro Technologies, CTS Telecom, BTI Systems (now Juniper), OPNET/Riverbed, and the Indian Institute of Technology Bombay (IITB). Done work with some of the highest-ranking law firms in the US on both the East and West-coasts of the country, providing intellectual property evaluation and assessment, and deep-dive technical consulting.

EDUCATION

Ph.D., **Electrical & Computer Engineering**, University of California, Santa Barbara.

1997

Thesis: "Efficient Communication Protocols and Performance Analysis for Gigabit Networks."

Advisor: Professor Emmanouel (Manos) Varvarigos.

M.S. (Computer Engineering), University of California, Santa Barbara.   1993
Thesis: "Frequency Assignment and Capacity Analysis for Cellular Radio."
Advisors: Professors Allen Gersho and Emmanouel (Manos) Varvarigos.

M.S. (Signals & Systems), University of California, Santa Barbara.   1993

B.Tech., **Electrical Engineering**, Indian Institute of Technology, Kanpur.   1991

  Project: "Design, Fabrication, and Testing of an Ethernet Repeater."

  Advisors: Professors K. R. Srivathsan and R. N. Biswas.

PROFESSIONAL POSITIONS

Principal, Metanoia, Inc., Silicon Valley, California.   2001 – present

-- Define company focus, devise strategy and growth plans, and develop customer outreach programs in niche-telecom advising for Metanoia, Inc. – interaction with C-level client executives

-- Facilitate deep-technical interaction with senior architects, planners, and design engineers at vendors and carriers

-- Technical expertise to telecom chip, system, and software companies and to service providers. Including:

  - Drive hardware/software architecture of multi-service systems – switches, routers, packet-optical gear used in WAN and metro networks, in data-center interconnects, and inside data centers

  - Advise service providers and telecom/datacom chip, system, and software vendors on:
    • Network architecture roadmap and services definition for Tier 1/2/3 carriers networks evolving to new services and/or products
    • System and network architecture, algorithm and protocol design, system analysis, standards
    • Analyzing advanced architecture issues to facilitate smart design: e.g., SDN or NFV applied to the WAN and the data-center, packet-optical integrated systems, next-generation Ethernet and/or SONET/SDH chip design, mobile 3G/4G/LTE and emerging 5G architectures, RAN virtualization, mobile backhaul strategies

  - Guide companies and industry professionals on topics at the forefront of contemporary networking, covering the latest advances in the design of systems, protocols, and architectures
    • IP networks and systems design: switch architectures, traffic engineering, IP-based VPNs, WiMAX/LTE/4G evolution/design, broadband wireless, 5G core and edge network architecture & design
    • Cloud-based technologies: intra- and inter-data center design – principles, methodologies, technologies – best-practices, public- and private-cloud technologies, hybrid cloud, tradeoff study

- Virtualization technologies: software-defined networking (SDN) and network functions virtualization (NFV) – technology insights and applications, deployment tradeoffs, and applications to, for e.g., RAN virtualization, 5G network slicing, EPC virtualization

- Participate in the Diffserv, MPLS, Traffic Engineering, L2/L3 VPNs, CCAMP, IP-over-Optical (IPO) WG's of the IETF (2001-2006)

Associate Professor (Contract), Dept. of Electrical Engineering, IIT Bombay, Mumbai, India and Silicon Valley, USA.   2004 – 2007

-- Lead research in wireline- and wireless-broadband access technologies, based on my past and ongoing industry experience. Established and lead the WiNETS (Wireless Networks) Research Group. Areas of focus and activities included:

- Metro/Access networks
  - Design of scheduling algorithms for 802.16 (WiMAX)-based broadband networks
  - Investigation and development of efficient traffic management schemes

- Wireless and Sensor networks
  - Development of an IEEE 802.15-based (Zigbee-based) ad-hoc wireless network testbed
  - Blueprint an indigenous sensor node, modeled after Berkeley MOTES
  - Architecture, modeling and analysis of stable routing protocols for ad-hoc networks
  - Large-scale simulations of QoS schemes in broadband wireless access (BWA) networks

- Network infrastructure security
  - Experiments and algorithms to assess security in 3G cellular networks
  - Scrutiny of security loopholes in Internet protocols (e.g., routing and signaling protocols)
  - Inference algorithms and tools for proactive detection of network security problems (e.g., in the RAN and backbone) in cellular data networks

- Mobile applications and architecture
  - Application development challenges in smart mobile devices
  - Research novel mobile software architectures to meet these challenges

-- Developed and taught junior- to- graduate-level courses, spanning digital circuits, basic electronics, and electronics laboratories to queueing theory, scheduling algorithms, circuit- and- packet-switching, and advanced networking protocols and systems to different class sizes, several exceeding 100+ students and a half-dozen+ teaching assistants.

-- Performed departmental service as Coordinator of Masters and Dual-Degree seminars and thesis allocation, evaluation, and assessment.

-- Served on Departmental Committees to interview incoming Masters and Ph.D. candidates, sat on evaluation committees for multiple Masters and Ph.D. students

-- Guided over a dozen graduate course research projects, two of which were accepted for publication in national conferences, and an extended version of one was accepted for publication at IEEE Globecom'06, one of IEEE's largest gatherings of researchers and practitioners of telecommunications.

-- Supervised graduate and undergraduate research and theses (remotely and/or in person when in India)
   • Eight students graduated; also co-guided two graduate/Ph.D. students.
   • Research focused on scheduling and traffic management algorithms for: high-speed switches and networks, broadband wireless (Wi-Max) networks, ad-hoc and sensor networks; network infrastructure security, and mobile applications and architecture.

Principal Architect, Jasmine Networks, Inc., San Jose, California.   2001

-- Architected and designed a common MPLS-based control plane for both packet and TDM data.

-- Strengthened Jasmine's industry standing by my leadership role in numerous MPLS forums

Research Engineer, Tellabs Research Center (TRC), Cambridge, Massachusetts.

1998 – 2000

-- Lead the IP networking research effort at the Cambridge office of the Research Center. Projects included:
   • Analysis and design of high-speed switch router architectures, conducted architectural evaluation of routers from over 10 leading core- and edge-router startups.
   • Strategic technical guidance to Tellabs' Advanced Business Development for acquisitions in the terabit router space.
   • Designed an IP flow management algorithm for application in parallel high-speed switches (patented).
   • Devised path protection schemes for multiprotocol label switching (MPLS) (patented) and formulated MPLS-based recovery framework.

-- Supervised a summer project for a Ph.D. student from MIT that produced a novel scheduling algorithm for parallel cross-bar switches that is part of the student's Ph.D. dissertation (patented).

-- Participated in the Diffserv, MPLS, Traffic Engineering, L2/L3 VPN WG's of the IETF. Contributed to MPLS recovery; eventually published as RFC 3469.

-- Responsible for selecting, screening, and phone interviewing a dozen candidates for the position of IP Networking Research Engineer at the Research Center.

Post-Doctoral Researcher, Multi-disciplinary Optical Switching Technology (MOST) Center, UCSB, Santa Barbara, California.   1997 – 1998

-- Designed and evaluated all-optical switches and switching schemes for WDM/DWDM networks, based on MEMS technologies.

-- Published one conference (IEEE MPPOI'98) and one journal (IEEE TON) paper.

INTELLECTUAL PROPERTY and PATENT ADVISING

-- Patent analysis and evaluation for investment houses, companies, and patent attorneys in a variety of circumstances -- portfolio acquisition and expansion, licensing, portfolio value assessment, patent strategy, and patent litigation.

-- Work has included: prior-art research in complex technology patents, claims review/de-construction, claim chart dissection, claim chart construction.

-- Infringement analysis, evidence-of-use investigation, technology analysis and violation, scrutinizing validity.

-- A major contribution of my work has been enabling complex telecommunications patents (in my areas of expertise) to be succinctly and easily understood by legal and investment experts.

-- Have served as an expert witness; have provided expert reports (e.g., on invalidity and non-infringement), and have been deposed.

AWARDS and HONORS

1. **Judge**, *Network Transformation Awards*, SDN NFV World Congress, The Hague, Netherlands, Oct. 14-17, 2019.

2.   **Judge** *Startup Elevate[3] – IoT Startup Pitch Fest (IoT Security, Industrial IoT, and Finals)*, IoT World, Santa Clara, CA, May 14-16, 2019.

3.   **Invited Keynote**, "*Today's Network Innovations: Fuel for Tomorrow's Network Transformation?*" Network Transformation Congress, San Jose, CA, April 30 – May 1, 2019.

4.   **Judge, MEF Ethernet Excellence Awards**, Announced at MEF GEN 17, Orlando, FL, November 13-16, 2017.

5.   **Invited Speaker** on "*Intellectual Property Challenges and IoT,*" IoT World, May 12, 2016.

6.   **Invited Attendee**, Open Networking Innovation Forum[4] (ONIF), Open Networking Summit (ONS), April 4, 2017, and March 27, 2018.

7.   **Group Owner & Manager**, Carrier Ethernet Group on LinkedIn, March 2012 - present. (12,021+ members spanning 140 nations, 3,128 companies, 6 continents)

8.   **Judge, MEF Ethernet Excellence Awards**, Announced at MEF GEN 16, Baltimore, MD, November 7-10, 2016.

9.   **Judge, MEF Ethernet Excellence Awards**, Announced at MEF GEN 15, Dallas, TX, November 16-19, 2015.

10. **Judge, MEF Ethernet Excellence Awards,** Announced at MEF GEN 14, Washington, D.C., November 17-20, 2014.

11. **IETE Fellow**, Elected by IETE Memberships Committee, February 2005.

12. **Subject Matter Expert**, MPLS Forum (now Broadband Forum), October 2002.

13. **IEEE Senior Member**, Elevated by IEEE Admissions & Advancement Committee, August 2001.

14. **Key Contributor Award**, Tellabs Operations, Inc., December 1999 and July 2000.

15. **Innovation Certificate**, Tellabs Operations, Inc., June 2000.

16. **Who's Who in Information Technology**, Inducted, February 1999.

17. **Judging Committee**, STC Student Technical Writing Contest, Santa Barbara, May 1996 & 1997.

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[3] From the Informa Tech/KNect365 website "Startup Elevate, formerly Project Kairos, is an exclusive startup program and community bringing together select investors and some of the most innovative startups disrupting the tech scene!"

[4] From the ONIF website "an invitation-only think-tank, gathering an elite group of open networking visionaries for a valuable dialog on the state of open networking." http://events.linuxfoundation.org/events/open-networking-summit/extend-the-experience/onif

18. **Winner**, STC Student Technical Writing Contest, Santa Barbara, May 1994 and 1995.

19. **Motorola Paul V. Galvin Fellow**, Sept. 1991-June 1993. (Fellowship awarded to only two engineers (a male and a female) throughout India for Masters study in the US.)

20. **Best B. Tech. Project** in Electrical Engineering, Indian Institute of Technology, Kanpur (IITK), 1991.

21. **National Talent Search Scholarship**, Govt. of India, 1985-1991 (Awarded, at that time, to only 330 candidates throughout India for undergraduate study.)

PATENTS GRANTED (US)

1. **Method and Apparatus for Validating a Path Through a Switched Optical Network**, 7,095,956, Issued August 22, 2006.

2. **Method and Apparatus to Switch Data Flows Using Parallel Switch Fabrics**, 7,123,581, Issued October 17, 2006.

3. **High-Speed Parallel Crossbar Switch**, 7,123,623, Issued October 17, 2006.

4. **Reverse Notification Tree for Data Networks**, 7,298,693 B1, Issued November 20, 2007.

5. **Method and Apparatus for Detecting MPLS Network Failures**, 7,315,510 B1 Issued January 1, 2008.

6. **System and Method for Network-Layer Protocol Routing in a Peer-Model Integrated Optical Network**, 7, 457, 277, Issued November 25, 2008.

7. **Method for Establishing an MPLS Data Network Protection Pathway**, 7,796,504, Issued September 14, 2010.

8. **Protection/Restoration of MPLS Networks**, 7,804,767, Issued September 28, 2010.

9. **Reverse Notification Tree for Data Networks**, 7,881,184, Issued February 1, 2011.

10. **Method and Apparatus for Detecting MPLS Network Failures**, 8,130,637 B1 Issued March 6, 2012.

11. **Reverse Notification Tree for Data Networks**, 8,588,058, Issued November 19, 2013.

12. **Method for Establishing an MPLS Data Network Protection Pathway**, 8,737,203, Issued May 27, 2014.

CONFERENCE SESSIONS CHAIRED/INVITED

1. **NFV and Zero Touch Forum**, Session Chair, NFV World Congress, San Jose, CA, April 26, 2018.

2. **SD-WAN & Business Forum**, Session Chair, NFV World Congress, San Jose, CA, May 4, 2017.

3. **Forum-2 Operations**, Session Chair, NFV World Congress, San Jose, CA, April 21, 2016.

4. "**Virtualization for 5G Network Architecture**" Invited Panel Chair, 5G Forum USA, Palo Alto, CA, April 12, 2016.

5. "**How do NFV and MEC Play Together? How Can Advances in NFV Synergistically Help in Advancing MEC?**" Leader, Interactive MEC Roundtable, MEC Focus Day, Carrier Network Virtualization, Palo Alto, CA, December 3, 2015.

6. "**CNV 2015 Day Two, Track A**," Session Chair, Carrier Network Virtualization, Palo Alto, CA, December 2, 2015.

7. "**Service Provider Technology Track 2**," Track Chair, MEF GEN 15, Dallas, TX, November 18, 2015.

8. "**Open Source IoT in the Cloud**," Session Chair, IoT Open-Source Summit at IoT World Summit, San Francisco, CA, May 13, 2015.

9. **"IP Management in Open Source,"** Chair, IoT Open Source Summit, IoT World, San Francisco, CA, May 13, 2015.

10. **SDx Summit**, Chair, Carrier Network Virtualization (CNV 2014), Palo Alto, CA, December 9, 2014.

11. "**If We Don't Have a Definition of What It Is, What Isn't SDN?**," Chairman, Debate/Roundtable, MPLS & Ethernet World Congress, Paris, France, March 13, 2013.

12. **Carriers World Middle East**, Chairman, Day One, Dubai, UAE, October 1, 2012.

13. "**MPLS End-to-End: A Realistic Paradigm?**," Chairman, Debate/Roundtable, MPLS & Ethernet World Congress, Paris, France, February 9, 2012.

14. "**Smart Management for Carrier Health and Reduced TCO!**" Panel, NANOG54, San Diego, CA, February 5, 2012.

15. "**MPLS-TP OAM and Use Cases**," Chairman, Debate/Roundtable, MPLS & Ethernet World Congress, Paris, France, February 2011. (I could not make the final

event due to a last-minute client scheduling conflict. The event was chaired by Carsten Rossenhoevel of EANTC, AG.)

16. "**Services, Session Resiliency & Convergence, OAM and Management**," Chairman, Day Three, MPLS & Ethernet World Congress, Paris, France, February 13, 2009.

17. "**MPLS/Ethernet Convergence, PBB-PBT-T-MPLS, Case Studies – BT, Wind, Belgacom**," Chairman, Day One, MPLS & Ethernet World Congress, Paris, France, February 6, 2008.

18. "**Resiliency, Case Studies, MPLS & Mobile Networks, Multicast Issues, Enterprise MPLS, and Testing**," Chairman, Day Three, MPLS & Ethernet World Congress, Paris, France, February 9, 2007.

19. "**Convergence, MPLS@10, Carrier Migration Strategies, Metro Ethernet & Access Network Issues**," Chairman, Day One, MPLS World Congress, Paris, France, February 7, 2006.

20. "**Next-Generation Multi-service Edge, Voice over MPLS, Interdomain Routing, Multicast Issues, BT Real-time Broadcast Video**," Chairman, Day One, MPLS World Congress, Paris, France, February 16, 2005.

21. "**Traffic Engineering, High-Availability Solutions, Optical, and New Applications for MPLS, and Case Studies**," Chairman, Day Three, MPLS World Congress, Paris, France, February 7, 2003.

22. "**Carrier Migration Strategies, Advances in Optical Components, Management & Planning of Optical Networks, Optical Network Evolution**," Co-Chairman, Industry Watch Program, SPIE Int'l Conference on Optical Networking and Communications (Opticomm 2002), Boston, MA, August 1, 2002.

PANELS CONCEIVED, DEVELOPED, & MODERATED, AND/OR PARTICIPATED

1. "**Impact of Disruptive Events: Challenges for Network Infrastructure**," Chair and Moderator, Critical Connections Conference, On-Line, April 29, 2020.

2. "**Where Are We on LEO?**," Invited Panelist, Space Intersects Internet: Into the (Low-Earth Orbit) LEO Constellations Era, Workshop in Barcelona, Spain and On-Line, February 27, 2020.

3. "**TDM, VoIP, Virtualization and the Future of the PSTN**," Invited Panelist, VoIP and the Independent Telecom, Virtual Conference, Sep. 30 – Oct. 4, 2019.

4. "**Digital Forensics: Global IP Challenges,**" Chair & Panelist, 45th Global Legal ConfEx and GDPR Expo, San Francisco, CA, Nov. 15, 2018.

5. "**Intellectual Property Ramifications in the Age of IoT**," Invited Chair/Moderator, Eoc-System Center Stage, IoT World, Santa Clara, CA, May 17, 2018.

6. "**How LPWAN Fills the Gap between Wide-Area Cellular and Local Area Short-Range Wireless Technologies**," Invited Panelist, IoT Architecture Symposium, IoT World, Santa Clara, CA, May 17, 2017.

7. "**Understanding Customer Data and Anticipating Needs**," Invited Panelist, IoT Analytics Symposium, IoT World, Santa Clara, CA, May 12, 2016.

8. "**Is NFV an Enabler for 5G and Mobile Edge Computing (MEC)?**," Leader Rountable, 5G Forum USA, Palo Alto, CA, April 13, 2016.

9. "**Roadmap and Requirements for Mobile Edge Computing (MEC): 2016 and Beyond**," Invited Panelist, Mobile Edge Computing (MEC) Focus Day, Carrier Network Virtualization, Palo Alto, CA, December 3, 2015.

10. "**Status of NFV Transformation Going Into 2016**," Invited Chair/Moderator, Carrier Network Virtualization, CNV 2015, Palo Alto, CA, December 2, 2015.

11. "**Network Functions Disaggregation: Innovations in NFV, SDNs, and Optical Networks**," Invited Moderator, MEF GEN 15, Dallas, TX, November 18, 2015.

12. "**Reliability in the NFV World – How Can 100% Service and Application Reliability be Achieved**," Invited Chair/Moderator, NFV World Congress, San Jose, CA, May 6, 2015.

13. "**The SDN & NFV Promise to Make the Network Agile and Optimum**," Invited Chair/Moderator, 5G Forum USA, Palo Alto, CA, April 15, 2015.

14. "**Evolution to a Software-Enabled Age**," Invited Moderator, SDx Summit, Carrier Network Virtualization, Palo Alto, CA, December 9, 2014.

15. "**Commercial Opportunities Posed by SDx**," Invited Moderator, SDx Summit, Carrier Network Virtualization, Palo Alto, CA, December 9, 2014.

16. "**Evolution of the Carrier Ethernet Professionals Community**," Invited Moderator, MEF's GEN 14, Washington, D.C., November 17, 2014. (Panelists from PLDT, Telin Singapore, & Sri Lanka Telecom.)

17. "**Mobile Backhaul – Energy Efficiency, Small Cells; Traffic Optimization – Multi-Layer Network Optimization & Capacity Planning**," Chairman, Day Three (morning), MPLS & SDN World Congress, Paris, France, March 22, 2013.

18. "**SDN: Reality Check!**," Chairman & Moderator, On-line Int'l Roundtable Series involving a dozen+ experts from, among others, IBM, Juniper, Alcatel-Lucent,

CIMI Corp, Infinera, Cyan, Ericsson, RAD, MRV Communications, and Current Analysis, February-March 2013.

19. "**Network-Centric Performance Management- So Near and Yet So Far**," Moderator & Coordinator, NANOG56, Dallas, TX, October 25, 2012.

20. "**End-to-End Performance Management & Monitoring for Operational Efficiency**," Moderator & Coordinator, On-line International Panel, involving a dozen+ experts from TELUS, Tata Communications, Twitter, Cisco, InfoVista, Packet Design, OPNET, CTS Telecom, LinkedIn, July 25, 2012.

21. "**Assessing Carrier Network Health for Reduced TCO**," Moderator & Coordinator, India Telco Summit, Mumbai, India, December 11, 2011.

22. "**Capacity Planning Panel**," Moderator & Coordinator, NANOG52, Denver, CO, June 11, 2011.

23. "**Access, Transport & Carrier Ethernet**," Invited Panelist, Debate, MPLS & Ethernet World Congress, Paris, France, February 11, 2009.

24. "**MPLS and Carrier Ethernet: Where and How? A Fruitful Conversation between Carrier Ethernet and MPLS Vendors Mediated by Service Providers**," Chairman, Debate/Roundtable, MPLS & Ethernet World Congress, Paris, France, February 7, 2007.

25. "**Carrier Ethernet and MPLS: Metro Access, Layer 2 VPNs, Pseudo-Wires and MS-PWs, VPLS, Inter-domain Issues & GMPLS Perspectives**," Chairman, Debate/Roundtable, MPLS World Congress, Paris, France, February 7, 2006.

26. "**Security & Scaling of MPLS, MPLS Network Migration & OSS and Billing, Edge/Metro/Access Network Issues for MPLS-based Services**," Chairman, Debate/Roundtable, MPLS World Congress, Paris, France, February 16, 2005.

27. "**Future Directions**," Invited Panelist, MPLS 2002, Washington, D.C., October 29, 2002.

28. "**The Optical Revolution: When?**," Invited Panelist, MPLSCon'02, March 2002, McLean, VA.

29. "**MPLS: State of the Art and Evolutions**," Invited Panelist, MPLS Forum, Paris, France, March 7-10, 2000.

TECHNICAL ONLINE SEMINARS DEVELOPED & CONDUCTED

1. "**SD-WAN Validation Using Network Emulation Tools**", CE Live! ™, Nov. 9, 2017. (With Neal Roche, CEO, Apposite Technologies, and Tom Nadeau, Principal, Lucidvision.)

2. "**The What, Why, and How of Open Networking and a Peek at the Open Networking Summit 2017**", CE Live! ™, March 16, 2017. (With Arpit Joshipura, GM Networking & Orchestration, Linux Foundation.)

3. "**Carrier Ethernet Network Management Systems – Architecture & Demo**," CE Live! ™, December 16, 2015. (With Roy Silon, VP Engineering and Yuri Denisov, Director, Product Management, Atrinet, Israel.)

4. "**The Business Case for Direct Connect**," CE Live! ™, October 22, 2015. (With William B. Norton, VP Research, IIX, CA; and Dumisani Dlamini, Dimension Data, Johannesburg, South Africa.)

5. "**Bandwidth Profiles in MEF 6.2, SDN Data Plane Design, State of Broadband, Industry News, and More**," CE Live! ™, June 26, 2015. (With Jon Fieffer, Fujitsu Network Communications, TX; Ralph Santitoro, MEF Distinguished Fellow, MEF & Fujitsu Network Communications, TX.)

6. "**Unraveling the MEF's Third Network & LSO Initiatives**," CE Live! ™, June 3, 2015. (With Rami Yaron, Co-Chair MEF Global Marketing Committee & VP of Strategy & Technology, Telco Systems, NJ.)

7. "**How Emerging Operators Could Evolve Towards the Cloud**," CE Live! ™, May 20, 2015. (With Amy Copley, Director of Service Provider Solutions, BTI Systems, Boston, MA.)

8. "**Carrier-Grade SDN, ALU-No ... More?, Ethernet Speeds, More NFV, and the "CE in the Cloud Age!" - Exclusive Workshop,**" CE Live! ™, May 5, 2015 (With Chandra Sekhar Mallela, Altera, Penag, Malaysia, Abdul Ravoof, Aricent, Pune, India.)

9. "**Network Performance, Lifecycle Service Orchestration, Viva Net Neutrality (?), Service Chaining, & Exploding Mobile Video!**," CE Live! ™, March 11, 2015.

10. "**SDN/NFV Technology Considerations, L2CP Matters, FB DC Designs, & Mobile Video**," CE Live! ™, February 25, 2015. (With Marcus Friman, Netrounds, Sweden; Khurram Shahzad, Technology Architect, Australia.)

11. "**Old School Telcos, Wheeler(ing) & Dealing, Virtual VNF's, SDDCs, 5G Small Cells! – Part 2**," CE Live! ™, February 18, 2015.

12. "**Old School Telcos, Wheeler(ing) & Dealing, Virtual VNF's, SDDCs, 5G Small Cells! – Part 1**," CE Live! ™, February 17, 2015. (With Hashiem Croeser, Neotel South Africa; Paolo Volpato Alcatel-Lucent, Italy; Larry Samberg, Twinspruces Consulting, Boston, MA.)

13. **"QoS & Traffic Mgt., Cloud WAN, SDN/NFV Strategy, Virtual CPEs, and More!,"** CE Live! ™, February 4, 2015. (With Scott Raynovich, Rayno Media, Inc., Bozeman, MT.)

14. **"Carrier Ethernet: Questions & Issues for Today**," CE Live! ™, December 28, 2012.

TECHNICAL ONLINE VIDEOS DESIGNED & PRODUCED

1. "**How Do Schedulers in Routers Work? Understanding RR, WRR, WFQ, and DRR Through Simple Examples**," Metanoia, Inc., Network Design & Architecture Series, March 9, 2016.

2. "**Which Scheduling Mechanisms are Implemented in Routers & Most Widely Deployed by Service Providers?**" Metanoia, Inc., Network Design & Architecture Series, March 9, 2016.

3. "**TC3 Carrier Case Studies – Part 3: Cloud Infrastructure (NTTI3 (USA, Japan) , TeliaSonera (Finland), BT (UK)),"** Metanoia, Inc., Network Design & Architecture Series, October 6, 2015.

4. "**TC3 Carrier Case Studies – Part 2: Improving Customer Experience (Bouygues Telecom (France), and Rogers (Canada),"** Metanoia, Inc., Network Design & Architecture Series, October 6, 2015.

5. "**TC3 Carrier Case Studies – Part 1: Wireless Infrastructure (EE(UK) and Telstra (Australia)),"** Metanoia, Inc., Network Design & Architecture Series, October 6, 2015.

6. "**What You Should Know About Working with Telcos Today! (Lessons from the TC3 Summit Operator Panel)**," Metanoia, Inc., Network Design & Architecture Series, October 5, 2015.

7. "**Key Takeaways for the Carrier Ethernet Ecosystem from TC3 Summit 2015**," Metanoia, Inc., Network Design & Architecture Series, October 4, 2015.

8. "**Understanding AIA, Alice & Open-Source: An Intellectual Property Troika for IoT (&Beyond!) Success**," Metanoia, Inc., February 20, 2015.

9. "**Why Are CIR/EIR Called Average Rates? What Does "Average" Really Mean?: Understanding Policer Rates**," Metanoia, Inc., Network Design & Architecture Series, February 13, 2015.

10. "**How Not To Configure Committed Burst Size (CBS) On Your Network**," Metanoia, Inc., Network Design & Architecture Series, February 11, 2015.

11.   "**Monitoring Service Uptime in a Multipoint-to-Multipoint Carrier Ethernet Service**," Metanoia, Inc., Network Design & Architecture Series, February 11, 2015.

12.   "**Performance Requirements for a PSN Delivering TDMoIP Traffic**," Metanoia, Inc., Network Design & Architecture Series, February 10, 2015.

WORKSHOPS/SEMINARS/TUTORIALS – designed, developed, and delivered

1.   "**A Fellow-Expert's Lessons Learned on Marketing a Forensic Expert Practice**," Webinar/Tutorial, Forensic Expert Witness Association, October 16, 2019.

2.   "**Understanding Military Grade Optical-Ethernet Networks: A Versatile Solution for Achieving DoD's Net-Centric Operations Strategy**," Industry Tutorial, IEEE Milcom'10, San Jose, CA, November 1, 2010. (With S. Davari, Broadcom Corp.)

3.   "**Elements of Cross-Layer System & Network Design for QoS-Enabled Wi-Max Networks**," Industry Tutorial, IEEE Milcom'07, Orlando, FL, October 29, 2007. (With Prof. A. Karandikar, IIT Bombay.)

4.   "**Appreciating Key Design Aspects of Wi-Max Networks**," Metanoia, Inc. "Next-Generation Systems and Networks" Workshop Series, Bangalore, India, July 17, 2007.

5.   "**Metro Ethernet: Understanding Key Underlying Technologies**," Metanoia, Inc. "Next-Generation Systems and Networks" Workshop Series, Bangalore, India, July 17, 2007.

6.   "**Facts You Should Know About QoS Enabled Wi-MAX Networks**," Metanoia, Inc. Workshop Series, Bangalore, India, January 25, 2007.

7.   "**Unraveling QoS in 802.16 Wireless Broadband Networks: The Role of MAC, Scheduling and Cross-Layer Design**," Industry Tutorial, IEEE Globecom'06, San Francisco, CA, November 27, 2006. (With Prof. A. Karandikar, IIT Bombay.)

8.   "**Multi-Protocol Label Switching: Basics and Applications**," Invited Seminar, Executives Meeting, Mahanagar Telephone Nigam Ltd. (MTNL), Mumbai, India, April 26, 2006.

9.   "**Modern IP-Based VPNs: Technology, Operation, Implementation & Design**," Metanoia, Inc. "Next-Generation Networking Technologies" Workshop Series, Bangalore, India, July 22-23, 2005.

10.   "**High-Performance Switch Architectures: Theory & Practice**," Metanoia, Inc. "Next-Generation Networking Technologies" Workshop Series, Bangalore, India, July 19-20, 2005.

11. "**Traffic Engineering: Techniques and Current Practices**," Short Course, Usha-Martin Academy of Communication Technology, Chennai, India, December 3, 2002.

12. "**Introduction to Optical Control Plane Standards & Technology: Overview, Discovery, Routing, Path Computation, Signaling, Inter-Domain Routing**," Short Course, Opticomm'02, Boston, MA, July 29, 2002. (With Dr. Greg Bernstein, Ciena.)

KEYNOTES & INVITED TALKS

1. "**Today's Network Innovations: Fuel for Tomorrow's Network Transformation?**," Invited Keynote, Network Transformation Congress, San Jose, CA, April 30 – May 1, 2019.

2. "**The Role of Zero Touch in NFV-Based Cloud Networking**," Chair's Market Highlights, NFV and Zero Touch Track, NFV World Congress, San Jose, CA, April 26, 2018.

3. "**The Evolution of SD-WAN and Implications for the Future**," Chair's Market Highlights, SD-WAN and Business Track, NFV World Congress, San Jose, CA, May 4, 2017.

4. "**Intellectual Property Challenges and IoT**," Invited Speaker, IoT Eco-System Center-Stage, IoT World, Santa Clara, CA, May 12, 2016.

5. "**Challenges and Opportunities in Operationalizing NFV**," Chair's Market Highlights, Forum 2 Operations, NFV World Congress, San Jose, CA, April 21, 2016.

6. "**Virtualization for 5G Network Architecture – An Introduction**," Opening Panel presentation, 5G Forum USA, Palo Alto, CA, April 12, 2016.

7. "**Software and Virtualization: Benefitting the Data Center and Beyond**," Opening Talk, SDx Summit, Carrier Network Virtualization, Palo Alto, CA, December 9, 2014.

8. "**Making the Intangible Tangible via R&D Innovation**," Invited Talk, 2nd Futurewei Vision Summit, Santa Clara, CA, November 6, 2014.

9. "**A WiMAX Shindig: Discussing Contemporary Technological and Market Issues**," Invited Talk, Forschungszentrum Telekommunikation Wien (FTW), Vienna, Austria, February 4, 2008.

10. "**Network Planning or Design: An Art or a Science**," SANOG (South-Asian Network Operators Group) 9, Plenary Keynote Talk, Colombo, Sri Lanka, January 23, 2007.

11.   "**A Survey of Canonical Features of, and Recent Advances in, IP Network Planning and Traffic Engineering (TE) Tools**," Invited Talk, Western Australia Telecom Research Institute (WATRI), Curtin University of Science & Technology, Perth, Australia, March 3, 2006.

12.   "**Network Infrastructure Security in Cellular Data Networks: An Initial Investigation**," Invited Talk, CSIRO (Commonwealth Scientific and Industrial Research Organization), Sydney, Australia, February 28, 2006.

13.   "**Inter-Domain TE and QoS: Some Key Aspects & Challenges**," Invited Talk, Australian Communication Industry Forum (ACIF), Sydney, Australia, February 27, 2006.

14.   "**Inter-Domain Traffic Engineering: Motivation, Key Aspects & Challenges**," Invited Talk, Acreo AB, Stockholm, Sweden, May 27, 2005.

15.   "**Does Self-Similarity of Internet Traffic Matter at Timescales Relevant to QoS**?," Invited Talk, Forschungszentrum Telekommunikation Wien (FTW), Vienna, Austria, February 15, 2005.

16.   "**Is Internet Traffic Self-Similar at Timescales Relevant to Quality-of-Service**," Invited Talk, Infosys Technologies & Wipro Technologies, Bangalore, India, December 22, 2004.

17.   "**Recent Advances in Network Planning/TE Tools: A Discussion**," Invited Seminar, SBC Network Services Engineering Group, San Ramon, CA, April 20, 2004.

18.   "**Carrier Strategies for Backbone Traffic Engineering and QoS**," Cisco NERD Lunch, San Jose, CA, February 26, 2004.

19.   "**Internet Traffic is Not Self-Similar at Timescale Relevant to QoS**," Invited Seminar, SBC Labs., San Ramon, CA, February 25, 2004. (Joint work with Arman Maghbouleh, Cariden; Thomas Telkamp, Global Crossing; Steve Gordon, SAIC.)

20.   "**Considerations for Inter-Domain Optical Routing**," Invited Talk, Fujitsu Labs. of America, Santa Clara, CA, May 17, 2002.

21.   "**Modern Carrier Strategies for Traffic Engineering**," Invited Talk at Infosys Technologies, Cisco Systems India Limited, Tejas Networks, Bangalore, India, November 28-December 1, 2002.

22.   "**Approaches to Designing a High-Performance Switch Router**," Invited Talk, HCL Technologies, Chennai, India, December 2, 2002.

23.   "**Approaches to Designing a High-Performance Switch Router**," Invited Talk at Wipro Technologies, Tata Elxsi Limited, Indian Institute of Science (IISc), Bangalore, India, November 28-December 1, 2002.

24. "**Approaches to Designing a High-Performance Switch Router**," Invited Talk at IIT Bombay, Mumbai, India, November 21, 2002.

25. "**An Assessment of QoS and Protection in MPLS**," Invited Talk, Tata Infotech Limited (now part of TCS), Mumbai, India, July 26, 1999.

CONFERENCE COMMITTEES

1. **Advisor, Speaker & Contributor**, IoT World, Informa Telecoms & Media/Knect365, April 2014 – Present.

2. **Advisor, Speaker & Contributor**, Carrier Network Virtualization, Informa Telecoms & Media/Knect365, August 2014 – August 2016.

3. **Advisor, Speaker & Contributor**, 5G Forum USA, Informa Telecoms & Media, January 2014 – 2016.

4. **Co-Chair, Cloud Infrastructure Track**, TiECon 2014, Santa Clara, CA, May 16, 2014.

5. **Advisory Board Member**, **Cloud Infrastructure Track**, TiECon 2014, December 2013 – May 2014.

6. **Member, Scientific Committee,** MPLS & SDN World Congress, Paris, France, 2013 - 2014.

7. **Advisory Board Member**, **Software-Defined Infrastructure Track**, TiECon 2013, December 2012 – May 2013.

8. **Advisory Board Member,** Carrier's World Asia**,** Terrapinn, Inc., November 2011 - March 2012.

9. **Steering Committee,** India Telco Summit, Mumbai, India, August – December 2011.

10. **Member, Scientific Committee,** MPLS & Ethernet World Congress, Paris, France, 2003-2012.

11. **Member, Scientific Committee**, Wi-Max Summit, Paris, France, 2005-2008.

12. **Board Member**, **Conference Advisory Board**, MPLSCon/FutureCon, 2001-2010.

13. **Technical Program Committee (TPC) Member**
    - iPOP (Int'l Conference on IP and Optical Networks), 2005-2012, 2014, 2015
    - IEEE Globecom, 2006, 2007, 2008
    - IEEE LAN/MAN Workshop, 2005, 2006, 2007
    - 1st International Workshop on Bandwidth-on-Demand, 2006.

- SPIE Opticomm, 2002, 2003.
- PATHNets, 2004.
- Internetworking, 2003.
- Int'l Workshop on Design of Reliable Communication Networks (DRCN) 2003, 2005.

INDUSTRY SERVICE

1. **IEEE eCareerMentor**, IEEE Mentor Centre, Advising IEEE members on career and professional matters, April 2013 – April 2020.

2. **Program Coordinator,** IEEE ComSoc SCV (Santa Clara Valley) Chapter**,** September 2013 - present.

3. **Group Leader, Moderator & Owner**, Carrier Ethernet Group on LinkedIn, March 2012 - present.

4. **Contributing Author,** "Generalized MPLS" MFA Forum (MPLS, Frame Relay, ATM Forum) Tutorial, June 2004.

5. **Core Contributor**, "Migrating to MPLS," MFA Forum (MPLS, Frame Relay, ATM Forum) Tutorial, December 2002

6. **Mentor, Stanford IEEE Mentor Program**, Stanford University, 2001-02 and 2002-03.

7. **Over 145+ invited talks, seminars, workshops, tutorials, colloquiums** at numerous organizations in the **US** (e.g., Cisco Systems, SBC Communications, Tellabs, Univ. of Colorado, George Washington Univ., Bell Labs, BBN/GTE, Fujitsu Labs., Cypress Semiconductor, RazaFoundries) and abroad: **Europe**: Acreo AB, *Sweden*, MPLS World Congress, *France*, FTW, Vienna, *Austria*; **India** (e.g., Indian Institute of Science, Indian Institutes of Technology (Bombay, Madras, Kanpur, Delhi), TataInfotech, Sasken Systems, Motorola India, Infosys, Wipro, Tata Elxsi, Cisco India, Tejas Networks, and HCL Technologies, MTNL (Mahanagar Telephone Nigam Ltd.), Tata Indicom/VSNL; **Australia**: Australian Communications Industry Forum (ACIF), Sydney, Australia, CSIRO (Commonwealth Industrial Scientific and Research Organization), Australia, Western Australian Telecom Research Institute (WATRI), Perth, Australia.

INDUSTRY COURSES COMPLETED

1. "**Photonic Technologies in the Data Center**," IEEE ComSoc, Training Course, April 22, 2020.

2. "**Next Generation Multi-Access Service Based 5G Architecture**," IEEE ComSoc, Training Course, Dec. 4, 2019.

3. "**Fundamentals of Small Cell 5G Deployments**," IEEE ComSoc, Training Course, Oct. 2, 2019.

4. "**High Throughput Satellites**," IEEE ComSoc, Training Course, June 12, 2019.

5. "**Optical Communications for 5G Wireless Networks**," IEEE ComSoc, Training Course, May 1, 2019.

6. "**Visible Light Communications**," IEEE ComSoc, Training Course, April 3, 2019.

7. "**Background Concepts of Optical Communication Systems**," IEEE ComSoc, Training Course, March 27, 2019.

8. "**Satellite Data Communications and VSAT**," IEEE ComSoc, Training Course, December 6, 2018.

9. "**IoT and M2M Essentials**," IEEE ComSoc, Training Course, June 6, 2018.

10. "**Beyond LTE: LTE Advanced, LTE Advanced Pro, and 5G,**" IEEE ComSoc, Training Course, February 28, 2018.

11. "**LTE Fundamentals: The Essentials**," IEEE ComSoc, Training Course, February 21, 2018.

12. "**Wireless Evolution of the Overall Network Architecture**," IEEE ComSoc, Training Course, February 7, 2018.

13. "**Network Function Virtualization (NFV), Software-Defined Networking (SDN) and the Road to 5G**," IEEE ComSoc, Training Course, January 31, 2018.

14. "**Intensive Wireless Communications Engineering: Current Practices**," IEEE ComSoc Continuing Education for Communications Professionals, IEEE Short-Course, Dec. 2-4, 2017.

CERTIFICATIONS EARNED

1. "**SDN/NFV Professional Certification**," MEF[5], June 15, 2018.

EDITORSHIPS

2. "**SDN Use Cases for Service Provider Networks: Part 2**," Co-Guest Editor, IEEE Communications Mag., Feature Topic Issue, April 2017.

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[5] MEF's first operator-grade, industry-wide certification that validates professionals' knowledge, skills and abilities in the domains of software-defined networking (SDN) and network functions virtualization (NFV).

3. "**SDN Use Cases for Service Provider Networks: Part 1**," Co-Guest Editor, IEEE Communications Mag., Feature Topic Issue, October 2016.

4. "**Next-Generation Carrier Ethernet Transport Technologies**," Co-Guest Editor, IEEE Communications Mag., Feature Topic Issue, March 2008.

5. "**Advances in Virtual Private Networks**," Co-Guest Editor, IEEE Communications Mag., Feature Topic Issue, April 2007.

6. "**Challenges in Enabling Inter-Provider Service Quality on the Internet**," Co-Guest Editor, IEEE Communications Mag., Feature Topic Issue, June 2005.

7. "**OAM in MPLS-based Networks**," Co-Guest Editor, IEEE Communications Mag., Feature Topic Issue, October 2004.

BOOK CHAPTERS

1. V. Sharma and A. Karandikar, "**Quality-of-Service in Wireless Networks**," Invited Chapter in Technical, Commercial, and Regulatory Challenges for QoS: An Internet Service-Model Perspective, by Xipeng Xiao, John Wiley & Sons, September 2008, Chapter 13, pp. 225-246.

2. V. Sharma and R. Sharma, "**Web Switching**," Invited contribution to Enterprise Networking: Multi-layer Switching and Applications, Idea Publishing Group, PA, USA, Eds. V. Theoharakis and D. Serpanos (Editors), January 2002, pp. 86-104.

INDUSTRY PUBLICATIONS

Industry Articles

1. V. Sharma, "**5 Fundamental Schedulers for Every System/Network Architect's Toolkit**," LinkedIn Pulse, March 23, 2016.

2. V. Sharma, "**4 Questions Network/System Architects Should Answer about Scheduling**," LinkedIn Pulse, March 21, 2016.

3. V. Sharma, "**What Challenges Do Carriers Face in Realizing an SDN/NFV Vision (Part 2 of 2)**," LinkedIn Pulse, November 6, 2015.

4. V. Sharma, "**What You Should Know About Working with Telcos Today**," LinkedIn Pulse, November 1, 2015.

5. V. Sharma, "**A Software-Defined (Kitchen) Sink!: Benefitting the Data Center and Beyond (Part 1 of 2)**", LinkedIn Pulse, October 15, 2015.

6. V. Sharma, "**SDN Protocol Wars, 4K IPTV, Open Ethernet for DCs, M2M for IoT, Open Media Alliance and More**," LinkedIn Pulse, October 4, 2015.

7. V. Sharma, "**On Mindmaps, Social Media, and SDN/NFV**," LinkedIn Pulse, July 30, 2015.

8. V. Sharma, "**Demystifying the MEF's Third Network and LSO**," LinkedIn Pulse, June 23, 2015.

9. V. Sharma, "**Smartly Defined Networks (SDN): How Rural Carriers Can Benefit from SDN, NFV and Cloud**," Invited Blog, Telecom Council of Silicon Valley, September 2014.

10. V. Sharma, A. Naveed, A. Udunuwara, A. Lior, "**Evolving Operator Network Architectures with Carrier Ethernet**," Industry Paper, Carrier Ethernet Academy, June 2013.

11. V. Sharma, "**Provider Network Health Assessment**," Intercomms Journal, October 2012, pp. 51-54.

12. V. Sharma, "**The Data Center Opportunity for Wholesale Carriers: But Performance Management is Key**," Wires & Waves, July 23, 2012.

13. V. Sharma, and A. Hadfield, "**How Does the Middle-Eastern Carrier Regain their Share of Enterprise Services**," Wires & Waves, May 27, 2012.

14. V. Sharma, and A. Hadfield, "**Where are the Next Big Profits Coming From?**," Wires & Waves, May 24, 2012.

15. V. Sharma, and A. Hadfield, "**Building the Future of the Wholesale Carrier**," Wires and Waves, May 23, 2012.

16. V. Sharma and M. Allen, "**Packet-Optical Integration**," Metanoia, Inc. Technology Paper, February 2011.

17. V. Sharma and M. Allen, "**Packet-Optical Integration – The Key to Evolving Towards Agile Optical Networks**," Photonic Tech Briefs, January 2011.

18. V. Sharma and S. Davari, "**Illuminating Optical Ethernet Networks!**," Metanoia, Inc. Technology Paper, March 2010.

19. V. Sharma and S. Davari, "**Demystifying Optical Ethernet Networks**," Photonic Tech. Briefs., February 2010.

20. V. Sharma, "**Smart Utilities: What Next-Generation Utilities are Gearing Up For**," Utility Products Magazine, Vol. 6, Issue 1, January 2009.

21. V. Sharma, "**Smart Utilities: What Are Next-Generation Utilities Gearing Up For?**," Metanoia, Inc. Technology Paper, June 28, 2008.

22. V. Sharma and A. Gumaste, "**Design considerations for converged optical Ethernet networks**," Photonic Tech. Briefs., February 2008.

23. V. Sharma and D. Sharma, "**Photonic switching, distributed routing and ultra-fast packet forwarding: key advances or pipe dream**," Communications Design Conference (CDC), September 30 - October 2, 2003, San Jose, CA.

24. D. Sharma and V. Sharma, "**Next-generation SONET/SDH: Impact on network deployment**," ChipCenter (an EE Times publication), Networking Series, Technical Note, April 2003.

25. V. Sharma, "**Building resilience in MPLS-controlled multi-layer networks**," Technical Focus, MPLSWorld, June 2002.

26. V. Sharma, "**Considerations for dynamic path establishment in MPLS-controlled multi-service networks**," Technical Focus, MPLSWorld, August 2001.

27. V. Sharma, "**Multiprotocol lambda switching: The role of IP technologies in controlling and managing future optical networks**," Tutorial in the First Online Symposium for Electronics Engineers (OSEE), January 2001.

Conference Presentations

1. V. Sharma, "**Network Architecture & Design Challenges for LEO Constellations: A Perspective**," Invited Presentation, Space Intersects Internet: Into the (Low-Earth Orbit) LEO Constellations Era Workshop, Barcelona, Spain and On-Line, February 27, 2020.

2. V. Sharma, "**Software and Virtualization: Benefitting the Data Center and Beyond ...**" SDx Summit, Carrier Network Virtualization, Palo Alto, CA, December 9, 2014.

3. K. Barapatre, N. Koshta, V. Sharma and F. Ricciato, "**Case study: Infrastructure security in cellular data networks**," APRICOT'06 (Asia-Pacific Regional Internet Conference on Operating Technologies), Perth, Australia, March 1-2, 2006.

4. V. Sharma, "**A survey of recent advances in traffic engineering/network planning tools**," APRICOT'06 (Asia-Pacific Regional Internet Conference on Operating Technologies), Perth, Australia, March 1-2, 2006.

5. K. Barapatre, N. Koshta, V. Sharma and F. Ricciato, "**Infrastructure security in cellular data networks: An initial investigation**," SANOG 7 (South-Asian Network Operators Group), Mumbai, India, January 23-24, 2006.

6. R Hartani and V. Sharma, "**State-of-the-art router design techniques for efficient MPLS network design and traffic engineering**," MPLS World 2004, Paris, France, February, 2004.

7.   R. Papneja and V. Sharma, "**Characterizing MPLS VPNs: Analysis and role of core routers**," MPLS 2002, Washington, D.C., October 27-29, 2002.

8.   V. Sharma and C. Srinivasan, "**Applications and Solutions for Point-to-Point Multiple Connection Setup in UNI 2.0**," OIF Booth, Supercomm 2002, Atlanta, GA, June 4, 2002.

9.   V. Sharma, "**Survivability considerations in MPLS-controlled multi-service networks**," MPLSCon Spring 2002, McLean, Virginia, March 25-28, 2002.

10. G. Bernstein and V. Sharma, "**Inter-domain routing considerations for MPLS-controlled optical networks**," MPLS World 2002, Paris, France, February 4-8, 2002.

11. S. Dharanikota et al, "**Inter-domain routing with shared risk groups**," MPLS World 2002, Paris, France, February 4-8, 2002.

12. V. Sharma, "**Dynamic path establishment in MPLS-controlled multi-service networks**," MPLSCon'01, San Jose, CA, March 26-29, 2001.

13. G. Bernstein, E. Mannie, V. Sharma, and B. Mack-Crane, "**Issues in MPLS-based control of SDH/SONET optical networks**," MPLS World Congress, Paris, France, February 6-9, 2001.

14. V. Sharma, V. Makam, C. Huang, and K. Owens, "**Protection and restoration in MPLS networks**," MPLS Forum 2000, Paris, France, March 7-10, 2000.

15. V. Sharma, V. Makam, C. Huang, and K. Owens, "**MPLS: Much potential leading somewhere: An assessment of QoS and protection in MPLS**," MPLS'99, Paris, France, June 22-25, 1999.

REFEREED PUBLICATIONS

Conferences

1.   M. Veerayya, V. Sharma, and A. Karandikar, "**A novel stability-based routing algorithm for QoS support in ad-hoc wireless networks**," Proc. IEEE Milcom'08, San Diego, CA, November 19-21, 2008.

2.   H. Rath, A. Karandikar, V. Sharma, "**Adaptive modulation-based TCP-aware uplink scheduling in IEEE 802.16 (Wi-Max) networks**," Proc. IEEE ICC'08, Beijing, China, May 2008.

3.   V. Sharma and N. Vamaney, "**The uniformly-fair deficit round-robin scheduler for IEEE 802.16 WiMax networks**," Proc. IEEE Milcom'07, Orlando, FL, October 2007.

4. A. Gumaste, J. Chandarana, P. Bafna, N. Ghani and V. Sharma, "**On control plane for service provisioning in light-trail WDM optical networks**," Proc. 42nd IEEE Intl Conf on Commun. (ICC), Glasgow, United Kingdom, June 2007.

5. H. Rath, A. Bhorkar, V. Sharma, "**An opportunistic uplink scheduling scheme to achieve bandwidth fairness and delay for multiclass traffic in Wi-Max (802.16) broadband networks**," IEEE Globecom'06, San Francisco, CA, November 27 –December 1, 2006.

6. H. Rath, A. Bhorkar, V. Sharma, "**An opportunistic deficit round robin (O-DRR) uplink scheduling scheme for Wi-Max networks**," Proc. IETE Int'l Conf. on Next-Generation Networks (ICNGN'06), Mumbai, India, February 9-11, 2006.

7. V. Bhedaru and V. Sharma, "**Packet classification algorithms for next-generation networks: A perspective**," Proc. IETE Int'l Conf. on Next-Generation Networks (ICNGN'06), Mumbai, India, February 9-11, 2006.

8. R. Rabbat, V. Sharma, F. Ricciato, R. Albanese, "**Strategies for rapid and scalable recovery in next-generation networks**," Proc. of Workshop 4, Protection and Restoration: From SDH/SONET to Next-Generation Networks, IEEE Globecom 2003, San Francisco, CA, December 1, 2003.

9. V. Sharma, A. Das, and C. Chen, "**Leveraging IP signaling and routing to manage UPSR-based SONET networks**," Proc. IEEE ICC 2003, Anchorage, Alaska, May 11-15, 2003.

10. B. Rajagopalan, D. Saha, G. Bernstein, and V. Sharma, "**Signaling for fast restoration in heterogeneous optical mesh networks**," Proc. SPIE Asia Pacific Conf. on Optical Communication, Beijing, China, November 12-16, 2001.

11. S. Mneimneh, V. Sharma, and K. Y. Siu, "**On scheduling using parallel input-output queued crossbar switches with no speedup**," Proc. IEEE Workshop on High-Perf. Switching and Routing (HPSR), May 2001.

12. D. Levandovsky, V. Makam, and V. Sharma, "**Physical constraints affecting connectivity in the dynamic optical network**," Proc. National Fiber Optic Engineers Conf. (NFOEC) Denver, CO, August 7-11, 2000.

13. C. H. Yeh, E. A. Varvarigos, V. Sharma, and B. Parhami, "**Scalable communication protocols for high-speed networks**," Proc. IASTED Int'l Conf. on Parallel and Distributed Computing Systems, Cambridge, MA, November 3-6, 1999.

14. J. P. Lang, V. Sharma, and E. A. Varvarigos, "**A new analysis for wavelength translation in regular all-optical networks**," Proc. MPPOI'98 (Massively Parallel Processing Using Optical Interconnections), Las Vegas, NV, June 15-17, 1998, pp. 131-139.

15. V. Sharma and E. A. Vavarigos, "**Limited wavelength translation in all-optical WDM mesh networks**," Proc. IEEE Infocom'98, San Francisco, CA, March 29 - April 2, 1998, pp. 893-901.

16. V. Sharma and E. A. Varvarigos, "**Some closed form results for circuit switching in hypercube networks with input queueing**," Proc. Euro-Par'96, Lyon, FR, August 27-29, 1996, pp.738-742.

17. V. Sharma and Srirajshekhar Koritala, "**Can distributed workgroups work without tears? Lessons learnt from coordinating a dispersed organization**," Proc. IEEE Int'l Conf. on Professional Communication (IPCC'96), Saratoga Springs, NY, September 17-20, 1996.

18. E. A. Varvarigos and V. Sharma, "**A loss-free connection control protocol for the Thunder and Lightning network**," Proc. IEEE Global Telecom. Conf., Singapore, November 13-17, 1995, pp. 450-456.

19. E. A. Varvarigos and V. Sharma, "**An efficient reservation connection control protocol for gigabit networks**," Proc. IEEE Int'l Symposium on Information Theory (ISIT), Whistler, BC, Canada, September 17-22, 1995, pp. 40.

20. E. A. Varvarigos and V. Sharma, "**Loss-free communication in high-speed networks**," Proc. Singapore Int'l. Conf. on Networks (SICON'95), July 3-7, 1995, pp. 230-236.

21. T. Kawashima, V. Sharma, and A. Gersho, "**Network control of speech bit rate for enhanced cellular CDMA performance**," Proc. Int'l. Conf. on Communications (ICC'94), New Orleans, LA, May 1-5, 1994, vol. 3, pp. 1276-80.

Journals & Magazines

1. A. Gumaste, V. Sharma, D. Kakadia, J. Yates, A. Clauberg, M. Voltolini, "**SDN Use-Cases for Service Provider Networks: Part 2**," Guest Editorial, IEEE Commun. Mag., vol. 55, no. 4, April 2017, pp. 62-63.

2. A. Gumaste, V. Sharma, D. Kakadia, J. Yates, A. Clauberg, M. Voltolini, "**SDN Use-Cases for Service Provider Networks: Part 1**," Guest Editorial, IEEE Commun. Mag., vol. 54, no. 10, October, 2016, pp. 80-81.

3. T. Nadeau, V. Sharma, and A. Gumaste, "**Next-generation Carrier Ethernet transport technologies**," Guest Editorial, IEEE Commun. Mag., vol. 46, no. 3, March 2008, pp. 67-68.

4. V. Sharma, N. Ghani, L. Fang, "**Advances in Virtual Private Networks**," Guest Editorial, IEEE Commun. Mag., vol. 45, no. 4, April 2007, pp. 24-25.

5. M. Morrow, V. Sharma, and T. Nadeau, L. Andersson, "**Challenges in enabling IP-service quality in the Internet**," Guest Editorial, IEEE Commun. Mag., vol. 43, no. 6, June 2005, pp. 88-90.

6. M. Morrow, V. Sharma, and T. Nadeau, "**OAM in MPLS-based networks**," Guest Editorial, IEEE Commun. Mag, vol. 42, no. 10, October 2004, pp. 88-90.

7. V. Sharma, A. Das, and C. Chen, "**On the issues in implementing the Peer Model in integrated optical networks**," Photonic Network Communications, Special Issue on the IP-Centric Control and Management of WDM Optical Networks, vol. 8, issue 1, June 2004, pp. 7-21.

8. V. Sharma, A. Das, and C. Chen, "**On the IP-oriented control of UPSR-based transport networks**," OSA J. of Optical Networking, vol. 2, no. 3, March 2003, pp. 69-82.

9. S. Mneimneh, V. Sharma, and Kai Yeung (Sunny) Siu, "**On scheduling using parallel input-output crossbar switches with no speedup**," IEEE/ACM Trans. on Networking, vol. 10, issue 5, October 2002, pp. 653-665.

10. C. Huang, V. Sharma, K. Owens, S. Makam "**Building reliable MPLS networks using a path protection mechanism**," IEEE Commun. Mag., vol. 40, no. 3, March 2002, pp. 156-162.

11. G. Bernstein, V. Sharma, and L. Ong, "**Inter-domain optical routing**," Optical Society of America (OSA) Journal of Optical Networking, vol. 1, no. 2, February 2002, pp. 80-92.

12. G. Bernstein, E. Mannie, V. Sharma, "**MPLS-based control of SDH/SONET optical networks**," IEEE Network, Special Issue on "IP-Optical Integration," vol.15, no. 5, July/August 2001, pp. 20-27.

13. J. P. Lang, V. Sharma, and E. A. Varvarigos, "**A new analysis for oblivious or adaptive routing in all-optical networks with wavelength translation**," IEEE/ACM Trans. on Networking, vol. 9, no. 4, August 2001, pp. 503-517.

14. V. Sharma and E. A. Vavarigos, "**An analysis of limited wavelength translation in regular all-optical WDM networks**," J. of Lightwave Technology, Special Issue on "Optical Networks," vol. 18, no. 12, December 2000, pp. 1606-1619.

15. E. A. Varvarigos and V. Sharma, "**An efficient reservation connection control protocol for gigabit networks**," Computer Networks and ISDN Systems, vol. 30, no. 12, July 1998, pp. 1135-1156.

16. E. A. Varvarigos and V. Sharma, "**The ready-to-go virtual circuit protocol: a loss-free protocol for gigabit networks with FIFO buffers**," IEEE/ACM Trans. on Networking, vol. 5, no. 5, October 1997, pp. 705-718.

17. V. Sharma and E. A. Varvarigos, "**Circuit switching with input queueing: An analysis for the d-dimensional wraparound mesh and the hypercube**," IEEE Trans. on Parallel and Distributed Systems, vol. 8, no. 4, April 1997, pp. 349-356.

18. T. Kawashima, V. Sharma, and A. Gersho, "**Capacity enhancement of cellular CDMA by traffic-based control of speech bit rate**," IEEE Trans. on Vehicular Technology, vol. 45, no. 3, August 1996, pp.543-550.

STANDARDS CONTRIBUTIONS

IETF RFCs Co-Authored

1. G. Bernsterin, E. Mannie, V. Sharma, E. Gray, "**A framework for GMPLS-based control of SDH/SONET networks**," RFC 4257, December 2005.

2. K. Kompella, Y. Rekhter (Editors) "**Routing Extensions in Support of Generalized MPLS**," RFC 4202, October 2005.

3. K. Kompella, Y. Rekhter (Editors) "**OSPF extensions in support of Generalized MPLS**," RFC 4203, October 2005.

4. K. Kompella, Y. Rekhter (Editors) "**IS-IS extensions in support of Generalized MPLS**," RFC 4205, October 2005.

5. E. Mannie (Ed.), "**Generalized Multi-Protocol Label Switching (MPLS) Architecture**," RFC 3945, October 2004.

6. E. Mannie, D. Papadimitrou (Editors), "**Generalized MPLS Extensions for Synchronous Optical Networks (SONET) and Synchronous Digital Hierarchy (SDH) Control,**" RFC 3946, October 2004.

7. V. Sharma and F. Hellstrand (Editors), "**A framework for MPLS-based recovery**," RFC3469, February 2003.

8. L. Berger (Editor), "**Generalized MPLS: Signaling functional description**," RFC 3471, January 2003.

9. P. Ashwood Smith, L. Berger (Editors), "**Generalized MPLS: Signaling – CR-LDP extensions**," RFC 3472, January 2003.

10. P. Ashwood Smith, L. Berger (Editors), "**Generalized MPLS: Signaling – RSVP-TE extensions**," RFC 3473, January 2003.

Representative OIF Contributions

1. G. Bernstein, L. Ong, V. Sharma, "**Bandwidth Encoding for NNI Routing**," OIF Contribution, OIF.2002.522.00, November 2002.

2. S. Dharanikota, R. Jain, C. Brownmiller, Y. Xue, D. Papadimitriou, G. Bernstein, R. Hartani, V. Sharma, "**Inter-domain Routing with Shared Risk Groups**," OIF Contribution OIF2001.227.1, April 23, 2001.

ACADEMIC COURSES/LABS DEVELOPED AND/OR TAUGHT

1. **Electronics Laboratory**, EE219, Dept. of EE, IIT Bombay   Fall 2006

    Junior-level course for electrical engineering majors (3 credits, 1 lab. per week) The course had 85 students and a dozen TA's, and was co-taught with Prof. Vishwesh Kulkarni of IIT Bombay.

2. **Digital Circuits Laboratory**, EE214, Dept. of EE, IIT Bombay   Spring 2006

    Junior-level course, offered to all electrical engineering majors (3 credits; one lab. per week). The course had 108 students, and was co-taught with Prof. Mukul Chandorkar.

3. **Telematics: Theory & Practice of High-Performance Circuit- & Packet-Switching**, EE612, Dept. of EE, IIT Bombay   Spring 2006, Spring 2005

    Advanced graduate-level course for electrical engineering and computer science majors (6 credits, 2 lectures per week). The course required students to do a substantive research project in teams of 2-3 each, with a report and final presentation, and had a dozen project research teams that were guided. One of the research reports was published in a national conference on networking.

4. **Advanced Data Networks**, EE740**,** Dept. of EE, IIT Bombay   Fall 2005

    Advanced graduate-level course for electrical engineering and computer science majors. (6 credits, 2 lectures/week) The course required students to do a substantive research project in teams of 2-3 each, with a report and final presentation, and had several project research teams that were guided. One of the research reports was published in a national conference on networking.

5. **Electronics for Engineers**, EE 004, Dept. of EE, IIT Bombay   Fall 2006, Fall 2004

    Junior-level course offered to non-EE engineering majors (4 credits; 2 lectures and 1 tutorial per week); the course had 100+ students both years, and over half-dozen TAs.

DEPARTMENTAL SERVICE AT IIT BOMBAY

1. Coordinator, Dual-Degree (Communications) Seminar Presentations & Evaluations, Fall 2005, Fall 2006.

2. Reviewer of a 30-lecture (1-1.5 hrs/lecture) course, Broadband Networks, for the Centre for Distance Engineering Education's (C-DEEP) National Program on Technology Enhanced Learning (NPTEL), Fall 2006.

3. Served on Departmental Interview Committee to screen and select M. Tech. applicants for Fall admission, May 2006.

4. Served on Departmental Interview Committee to screen and select Ph.D. applicants for Fall admission, May 2006.

5. Contributions to the Departmental 5-Year Growth Plan, Fall 2005.

6. Served on Faculty Interview Committee to interact with a number of potential faculty members visiting the Department, Fall 2005 – Fall 2006.

7. Conceived, developed, and delivered the TA Orientation Workshop in the Dept. of EE, Spring 2005 and Fall 2006.

   This established the first TA orientation program within the department, to effect a better matching between the expectations of the faculty and the incoming TAs, and provided incoming graduate students training in effective communication. (Jointly with Prof. S. D. Agashe.)

8. Examiner for a dozen+ B. Tech, Dual-Degree, M.Tech. & Ph.D. seminars, projects, and theses, Spring 2005 – Fall 2006.

9. Contributed to Faculty Meeting discussions on enhancing the Department's TA system, leading to the institution of a TA Orientation Workshop for incoming graduate students, Spring and Fall 2005.

GRADUATED STUDENTS

Undergraduate Theses Supervised (B. Tech.[6])

1. "**Energy-Aware Routing Protocols in Ad-Hoc Networks**," K. Jain, May 2007.

2. "**Security and Performance Analysis of Cellular Data Networks**," N. Agrawal, May 2007.

3. "**Designing and Implementing a Basic Ad-Hoc Wireless Network Testbed**," S. Chaudhari, June 2006. (Winner, Best B. Tech Project in Electrical Engineering Award at IIT Bombay for the academic year 2005-2006.)

4. "**Experiments to Assess Security in Cellular Data Networks**," N. Koshta, April 2006. Research published in SANOG'06 and APRICOT'06.

Graduate Theses Supervised (M. Tech.[7] and Dual Degree (B. Tech./M. Tech.)[8])

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[6] B. Tech. = Bachelor of Technology, a 4 -year undergraduate program of study.

1. "**Energy-Aware On-Demand Routing Protocol for Ad-Hoc Wireless Networks**," M. Veeraya, July 2008. (Co-guided with Prof. Abhay Karandikar, IIT Bombay.) Research published in IEEE Milcom'08.

2. "**Realizing a Peer-to-Peer Mobile Multiplayer Game for 3G Networks**," P. Khandelwal, July 2007.

3. "**Scheduling in IEEE 802.16 Metropolitan Area Networks**," N. Vamaney, September 2006. Research published in IEEE Milcom'07.

4. "**Evaluation of Network Properties and Security in Cellular Data Networks**," K. Barapatre, August 2006. (Co-guided with Dr. Fabio Ricciato, FTW, Vienna, Austria.) Research published in SANOG'06 (South Asian Network Operators Group) and APRICOT'06 (Asia-Pacific Regional Internet Conference).

RESEARCH GUIDANCE

B. Tech Seminars

1. "**Routing Protocols for Ad-Hoc Wireless Networks**," C. Singla, Spring 2007.

2. "**Metro Ethernet Networks**," M. Shakya, Spring 2007.

3. "**Routing in Ad-Hoc Wireless Networks**," K. Jain, Spring 2006.

4. "**3G Cellular Networks – Architecture and Security Issues**," N. Agrawal, Spring 2006.

5. "**Design of MAC Protocols and PHY Layer in the IEEE 802.16 Standard**," N. Koshta, Spring 2005.

6. "**Scheduling Algorithms in Broadband Wireless Networks**," S. Chaudhari, Spring 2005.

M. Tech Seminars

1. "**Traffic Management Techniques**," A. Bhattacharya, Fall 2006.

2. "**Mobile Handset Architectures**," S. Bandekar, Fall 2005.

3. "**Investigation of Security Threats to Network Protocols**," A. R. Dixit, Fall 2005.

4. "**Architecture of Mobile Platforms and Mobile Applications**," P. Khandelwal, Fall 2005.

Ph.D. Seminars

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[7] M. Tech. = Master of Technology, a 2-year graduate program of study.
[8] Dual Degree = A combined B. Tech. and M. Tech. degree awarded at the end of a 5-year program of study.

1. "**Cross-Layer Based Resource Allocation in Wireless Networks**," H. K. Rath, Annual Progress Report Seminar, August 2007.

Research Fellow Project

1. "**Design and Specification of QoS Architecture Components for an IEEE 802.16 Compatible QoS Architecture**," R. Nalwade, Fall 2005.

Course Research Projects (Graduate Courses)

1. "**Matching Algorithms for Clos Networks**," A. D. Rajan, O. V. S. Bharadwaj, Spring 2006.

2. "**Stability of Networks of Input-Queued Switches**," D. A. Sudhir, A. Bhattacharya, H. P. Shringarpure, Spring 2006.

3. "**Optics Inside Routers**," S. G. Bandekar, P. S. Kulkarni, Spring 2006.

4. "**Active Queue Management: RED and WRED**," S. Iyengar, B. K. Tejaswi, S. Sapavat, Fall 2005.

5. "**Modern Algorithms for Traffic Engineering in IP Networks**," N. Vamaney, BP Vipin Kumar, U. K. Pandey, Fall 2005.

6. "**Delay-Based Congestion Avoidance Algorithms for TCP**," P. Manohar, O. Kulkarni, A. Bhorkar, Fall 2005.

7. "**Packet-Classification Algorithms and Their Realization**," V. Bhedaru, S. R. Anil Kumar, K. Barapatre, Fall 2005.

8. "**QoS Mechanisms for Multi-media Delivery over Wireless IP Networks**," A. Singh, S. K. Das, P. K. Kapadia, Fall 2005.

9. "**Video Traffic over Cellular Wireless Networks**," A. Malewar, A. Gupta, B. Walia, Fall 2005.

10. "**QoS Monitoring/Tracking for Network Planning in 3G Cellular Networks**," A. Mukherji, D. Mehta, K. Mumru, Fall 2005.

11. "**Study of Routing and Congestion Control in SS7 Networks**," G. Kumar, T. D. Shiva, Spring 2005.

12. "**MAC Layer Scheduling in IEEE 802.16e Networks**," H. K. Rath, A. Bhorkar, Spring 2005.

13. "**Routing and Wavelength Assignment Issues in Optical Networks**," A. Singh, S. K. Das, N. Vamaney, Spring 2005.

14. "**Layering in Telecom Networks: G.805 and G.809**," B. K. Tejasw, C. R. Parekh, Spring 2005.

15. "**Path Setup in Multi-Priority MPLS Networks**," S. Goyal, A. K. Gupta, R. R. Chowgule, Spring 2005.

16. "**Capacity, Routing and QoS in Indoor Wireless Mesh Networks**," G. Bhati, D. Angrula, Spring 2005.

17. "**VoIP: Architecture, Protocols/Subsystems, and Security**," S. Chakraborty, Ajishna G., B. S. Walia, Spring 2005.

18. "**Peering Strategies in IP Networks**," P. C. Mehta, C. M. Pujara, V. B. Bhedaru, Spring 2005.

19. "**Peering and Interconnects in IP and Phone Networks**," M. G. Kata, S. J. Deb, N. Dalmia, Spring 2005

20. "**Content Delivery Networks: Design and Architecture Issues**," D. Mehta, V. Kashyap, U. Pandey, Spring 2005.